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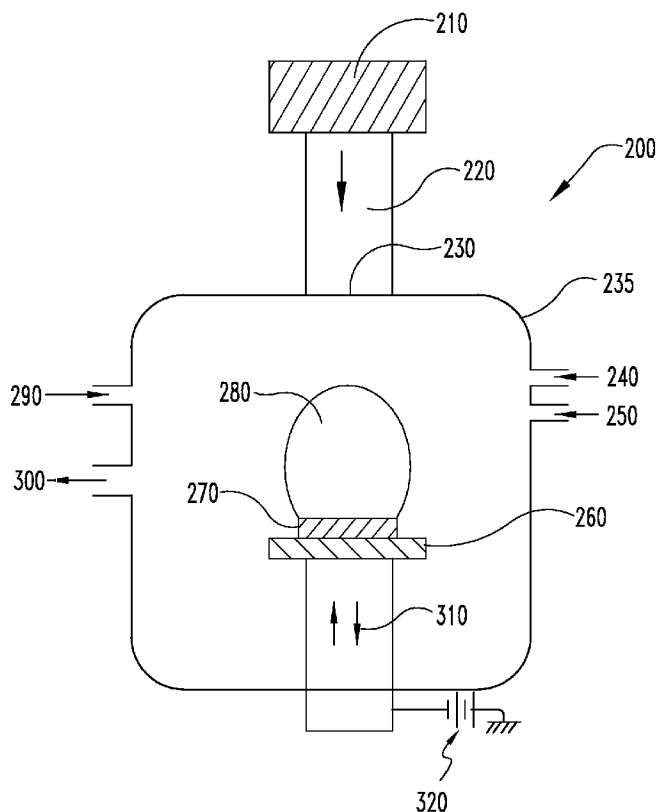
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[Continued on next page]

(54) Title: MATERIALS AND METHODS FOR THE MANUFACTURE OF LARGE CRYSTAL DIAMONDS



(57) Abstract: Materials and methods are provided for forming single crystal diamond growth using microwave plasma chemical vapor deposition (CVD) process in partial vacuum with a gaseous mixture containing a methane/hydrogen mixture with optional nitrogen, oxygen and xenon addition. The single crystal substrate can be formed by a modified directional solidification process starting with at least one of the following: pure nickel or a nickel alloy which includes cobalt, iron, or a combination thereof using a vacuum induction melting process. A surface of the single crystal substrate is coated using an electron beam evaporation device with pure iridium or an alloy of iridium and a component selected from the group consisting of iron, cobalt, nickel, molybdenum, rhenium and a combination thereof. The alloy coated single crystal substrate is positioned in a microwave plasma CVD reactor and upon being subjected to a biased enhanced nucleation treatment in the presence of a gaseous mixture of methane, hydrogen, and other optional gases with a biased voltage of negative 100 to 400 volts supports the growth of a large single crystal diamond on its coated surface.



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A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - C30B 25/00; C01 B 31/06 (2007.01)

USPC - 117/88: 423/446

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
USPC - 117/88; 423/446

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
USPC - 117/104; 117/29, 117/104; 117/95; 117/68, 117/79

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

PUBWEST (USPT, PGPB, USOC, EPAB and JPAB); Google Scholar and Google Patent- single crystal diamond, CVD, mixture of gases, iridium, X-ray diffraction, single crystal substrate, coating

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 6,080,378 A (YOKOTA et al) 27 June 2000 (27 06.2000); entire document, esp col 3, ln 25-27; col 1, ln 7,8, col 4, ln 30	1-119
Y	ASHFOLD et al Thin film diamond by chemical vapour deposition methods Chemical Society Reviews, February 1994, 23(1) 21-30, entire document, esp pgs 22, 23, 26 and 27; Fig 2	1-119
Y	US 5,400,738 A (SHIOMI et al), 28 March 1995 (28 03.1995); entire document, esp col 2, ln 16-22, 46, 55, 45; col 4, Table 1, col 1, ln 13, 14; col 3, ln 16-18	4-7, 11-14, 18-21 and 25-28
Y	US 5,571,603 A (UTUMI et al), 05 November 1996 (05.11.1996), entire document, esp col 4, ln 38; col 5, ln 41-46; col 2, ln 27-31, col 3, ln 50; col 13, ln 43	29-31, 48-50, 56-61, 67-81 and 98-103
Y	YAN et al, Very high growth rate chemical vapor deposition of single-crystal diamond, PNAS, 01 October 2002; 99(20) 12523-12525; entire document, esp pgs 12523 and pg 12524	29-31, 105-107, 109-111, 113-115 and 117-119
Y	US 5,915,194 A (POWELL et al), 22 June 1999 (22 06.1999); entire document, esp col 7, ln 36-44, 25, 30-32, col 8, ln 19-21, col 11, ln 15-17, 19-20, col 10, ln 3, 49, 60, 26, col 12, ln 64-65, claim 20, step (i), col 3, ln 52, 61, col 15, ln 5-6	32-81 and 98-119
Y	US 5,273,708 A (FREEMAN), 28 December 1993 (28 12 1993), entire document, esp. col 6, ln 3-7; col 4, ln 13-17, 57-59	33-36, 38, 39, 41-44, 46-81 and 98-103

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"P" document published prior to the international filing date but later than the priority date claimed

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"Y" document of particular relevance, the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"S" document member of the same patent family

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